

## Material Safety Data Sheet

### 1. Product and Company Identification

**Important Note:** As a solid, manufactured article, exposure to hazardous ingredients is not expected with normal use. This battery is an article pursuant to 29 CFR 1910.1200 and, as such, is not subject to the OSHA Hazard Communication Standard requirement. The information contained in this Material Safety Data Sheet contains valuable information critical to the safe handling and proper use of the product. This MSDS should be retained and available for employees and other users of this product.

#### Commercial product name

INR18650-20R

#### Use of the substance/preparation

Lithium-Ion battery

#### Manufacturer

SAMSUNG SDI Co., LTD

#### Address

HQ: 428-5, Gongse-dong, Giheung-gu, Yongin-si, Gyeonggi-do, Korea

#### Company/undertaking identification

Emergency Contact(Chemtrec)

1-800-424-9300: US and Canada / 1-703-527-3887: International

#### **Further Information**

Battery-System: Lithium-Ion (Li-ion)

Nominal Voltage: 3.6 V

Rated Capacity: 1.95 Ah

Wh rating: 7.02 Wh

Anode (negative electrode): based on intercalation graphite

Cathode (positive electrode): based on lithiated metal oxide (Cobalt, Nickel, Manganese)

#### **Remark:**

The information and recommendations set forth are made in good faith and believed to be accurate as of the date of preparation. SAMSUNG SDI Co., Ltd. makes no warranty, expressed or implied, with respect to this information and disclaims all liabilities from reliance on it.

### 2. Hazards Identification

#### **Route(s) of Entry**

There is no hazard when the measures for handling and storage are followed.

#### **Signs and Symptoms of Exposure**

In case of cell damage, possible release of dangerous substances and a flammable gas mixture.



OSHA Hazard Communication: This material is not considered hazardous by the OSHA Hazard Communication Standard 29CFR 1910.1200.

Carcinogenicity (NTP): Not listed  
Carcinogenicity (IARC): Not listed  
Carcinogenicity (OSHA): Not listed

### Special hazards for human health and environment

There is no hazard when the measures for handling and storage are followed.

In case of cell damage, possible release of dangerous substances and a flammable gas mixture.

### 3. Composition/information on ingredients

#### Hazardous components

| CAS-No.    | Chemical name                  | Quantity |
|------------|--------------------------------|----------|
| 1307-96-6  | Cobalt oxide                   | < 30 %   |
| 1313-13-9  | Manganese dioxide              | < 30 %   |
| 1313-99-1  | Nickel oxide                   | < 30 %   |
| 7440-44-0  | Carbon                         | < 30 %   |
|            | Electrolyte (*)                | < 20 %   |
| 24937-79-9 | Polyvinylidene fluoride (PVdF) | < 10 %   |
| 7429-90-5  | Aluminium foil                 | 2 - 10 % |
| 7440-50-8  | Copper foil                    | 2 - 10 % |
|            | Aluminium and inert materials  | 5 - 10 % |

Full text of each relevant R phrase can be found in heading 16.

#### Further Information

For information purposes:

(\*) Main ingredients: Lithium hexafluorophosphate, organic carbonates

Because of the cell structure the dangerous ingredients will not be available if used properly.

During charge process a lithium graphite intercalation phase is formed.

Mercury content: Hg < 0.1mg/kg

Cadmium content: Cd < 1mg/kg

Lead content: Pb < 10mg/kg

### 4. First Aid Measures

#### General information

The following first aid measures are required only in case of exposure to interior battery components after damage of the external battery casing.

Undamaged, closed cells do not represent a danger to the health.

#### After inhalation



Ensure of fresh air. Consult a physician.

**After contact with skin**

In case of contact with skin wash off immediately with plenty of water. Consult a physician.

**After contact with eyes**

Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Seek medical treatment by eye specialist.

**After ingestion**

Drink plenty of water.  
Call a physician immediately.

**5. Fire Fighting Measures**

**Suitable extinguishing media**

Cold water and dry powder in large amount are applicable.  
Use metal fire extinction powder or dry sand if only few cells are involved.

**Special hazards arising from the chemical**

May form hydrofluoric acid if electrolyte comes into contact with water.  
In case of fire, the formation of the following flue gases cannot be excluded:  
Hydrogen fluoride (HF), Carbon monoxide and carbon dioxide.

**Protective equipment and precautions for firefighters**

Wear self-contained breathing apparatus and protective suit.  
Additional information  
If possible, remove cell(s) from fire fighting area. If heated above 125°C, cell(s) can explode/vent. Cell is not flammable but internal organic material will burn if the cell is incinerated.

**6. Accidental Release Measures**

**Personal precautions**

Use personal protective clothing.  
Avoid contact with skin, eyes and clothing.  
Avoid breathing fume and gas.

**Environmental precautions**

Do not discharge into the drains/surface waters/groundwater.  
Methods for cleaning up/taking up  
Take up mechanically and send for disposal.

**7. Handling and Storage**

**Handling**

**Advice on safe handling**

Avoid short circuiting the cell. Avoid mechanical damage of the cell. Do not open or disassemble.  
Advice on protection against fire and explosion  
Keep away from open flames, hot surfaces and sources of ignition.



**Storage**

**Requirements for storage rooms and vessels**

Storage at room temperature (approx. 20°C) at approx. 20-60% of the nominal capacity (OCV approx. 3.6 - 3.9 V/cell).  
 Keep in closed original container.

**8. Exposure controls/personal protection Exposure limit values Exposure limits**

| Ingredient           | Risk Codes  | Safety Description                                  | Hazard  | Exposure Controls/Personal Protection   |
|----------------------|---|---|---|---|
| Cobalt oxide         | R22;R43;<br>R50/53  | S24;S37;S60;S61                                     | Xn(Harmful)<br>N<br>(Dangerous for the environment) | 0.1 mg/m <sup>3</sup> (TWA)   |
| Manganese (VI) oxide | R20/22  | S25   | Xn(Harmful)   | <b>Airborne Exposure Limits:</b><br>- OSHA Permissible Exposure Limit (PEL): 5 mg/m <sup>3</sup> Ceiling for manganese compounds as Mn<br>- ACGIH Threshold Limit Value (TLV): 0.2 mg/m <sup>3</sup> (TWA) for manganese, elemental and inorganic compounds as Mn   |
| Nickel oxide         | R43,R49,<br>R53   | S45,S53,S61   | T(Toxic)  | <b>Airborne Exposure Limits:</b><br>For Nickel, Metal and Insoluble Compounds, as Ni:<br>- OSHA Permissible Exposure Limits (PEL) - 1 mg/m <sup>3</sup> (TWA).<br>For Nickel, Elemental / Metal:<br>- ACGIH Threshold Limit Value (TLV) - 1.5 mg/m <sup>3</sup> (TWA), A5 - Not suspected as a human carcinogen.<br>For Nickel, Insoluble Compounds, as Ni:<br>- ACGIH Threshold Limit Value (TLV) - 0.2 mg/m <sup>3</sup> (TWA), A1 - Confirmed human carcinogen |
| Carbon               | R36/37/38,<br>R36/37<br>R20, R10  | S22;S24/25  | F(Highly Flammable)<br>Xn(Harmful)<br>Xi(Irritant)  | <b>Airborne Exposure Limits:</b><br>- OSHA Permissible Exposure Limits (PELs): activated carbon (graphite, synthetic): Total particulate = 15 mg/m <sup>3</sup>   |
| Aluminium foil       | R17,R15,<br>R36/38,<br>R10,R67,<br>R65,R62,<br>R51/53,<br>R48/20,<br>R38,R11, | S7/8,S43,S26,S62,<br>S61, S36/37,<br>S33,S29,S16,S9 | F(Highly Flammable)<br>Xn(Harmful)<br>Xi(Irritant)  | <b>Airborne Exposure Limits:</b><br>-OSHA Permissible Exposure Limit (PEL): 15 mg/m <sup>3</sup> (TWA) total dust and 5 mg/m <sup>3</sup> (TWA) respirable fraction for Aluminum metal as Al<br>-ACGIH Threshold Limit Value (TLV): 10 mg/m <sup>3</sup> (TWA) Aluminum metal dusts   |



|                                |                    |                           |   |   |
|--------------------------------|--------------------|---------------------------|---|---|
| Copper foil                    | R11 R36<br>R37 R38 | S5,S26,S16,S61,<br>S36/37 | F(Highly Flammable)<br>N(Dangerous for<br>the environment)<br>Xn(Harmful)<br>Xi(Irritant) | Copper Dust and Mists, as Cu:<br>- OSHA Permissible Exposure Limit (PEL) -<br>1 mg/m3 (TWA)<br>- ACGIH Threshold Limit Value (TLV) -<br>1 mg/m3 (TWA)<br>Copper Fume:<br>- OSHA Permissible Exposure Limit (PEL) -<br>0.1 mg/m3 (TWA)<br>- ACGIH Threshold Limit Value (TLV) -<br>0.2 mg/m3 (TWA) |
| Polyvinylidene fluoride (PVdF) |                    | S22;S24/25                |   |   |

**Additional advice on limit values**

During normal charging and discharging there is no release of product.

**Occupational exposure controls**

No specific precautions necessary.

**Protective and hygiene measures**

When using do not eat, drink or smoke. Wash hands before breaks and after work.

**Respiratory protection**

No specific precautions necessary.

**Hand protection**

No specific precautions necessary.

**Eye protection**

No specific precautions necessary.

**Skin protection**

No specific precautions necessary.

**9. Physical and Chemical Properties**

**Appearance**

Form: Solid  
 Color: Various  
 Odor: Odourless

**Important health, safety and environmental information**

Test method

pHValue: n.a.  
 Flash point: n.a.  
 Lower explosion limits: n.a.  
 Vapour pressure: n.a.  
 Density: n.a.



Water solubility:  
Ignition temperature:

Insoluble  
n.a.

## **10. Stability and Reactivity USA, EU**

### **Stability**

Stable

### **Conditions to avoid**

Keep away from open flames, hot surfaces and sources of ignition. Do not puncture, crush or incinerate.

### **Materials to avoid**

No materials to be especially mentioned.

### **Hazardous decomposition products**

In case of open cells, there is the possibility of hydrofluoric acid and carbon monoxide release.

### **Possibility of Hazardous Reactions**

Will not occur

### **Additional information**

No decomposition if stored and applied as directed.

## **11. Toxicological Information**

### **Empirical data on effects on humans**

If appropriately handled and if in accordance with the general hygienic rules, no damages to health have become known.

## **12. Ecological Information**

### **Further information**

Ecological injuries are not known or expected under normal use. Do not flush into surface water or sanitary sewer system.

## **13. Disposal Considerations**

### **Advice on disposal**

For recycling consult manufacturer.

### **Contaminated packaging**

Disposal in accordance with local regulations.

## **14. Transport Information**

The rechargeable Lithium-Ion battery pack as stated in Appendix are made in compliance to the requirements stated in the latest edition of the IATA Dangerous Goods Regulations Packing Instruction 965,966,967 section II such that they can be transported as a NOT RESTRICTED (non-hazardous/non-dangerous) goods. However, if those lithium-ion battery packs are pack with or contained in an equipment, then it is the responsibility of the shipper to ensure that the consignment are



packed in compliance to the latest edition of the IATA Dangerous Goods Regulations section II of either Packing Instruction 966 or 967 in order for that consignment to be declared as NOT RESTRICTED (non-hazardous/non-Dangerous).

With regard to transport, the following regulations are cited and considered:

- The International Civil Aviation Organization (ICAO) Technical Instructions, Packing Instruction 965,966,967 Section II (2013-2014 Edition),
- The International Air Transport Association (IATA) Dangerous Goods Regulations, Packing Instruction 965,966,967 Section II (54th Edition, 2013)
- The International Maritime Dangerous Goods (IMDG) Code (2010 Edition),
- US Hazardous Materials Regulations 49 CFR(Code of Federal Regulations) Sections 173-185 Lithium batteries and cells,
- The UN Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria 38.3 Lithium batteries, Rev.5, Amend.1
- UN No. 3480 & UN No. 3481
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Our products are properly classified, described, packaged, marked, and labeled, and are in proper condition for transportation according to all the applicable international and national governmental regulations, not limited to the above mentioned. We further certify that the enclosed products have been tested and fulfilled the requirements and conditions in accordance with UN Recommendations (T1 – T8) on the Transport of Dangerous Goods Model Regulations and the Manual of Tests and Criteria that can be treated as “Non-Dangerous Goods”.

**Test results of the UN Recommendation on the Transport of Dangerous Goods**

| <b>Manual of Test and Criteria (38.3 Lithium battery)</b> |                        | <b>Test Results</b> | <b>Remark</b> |
|---|------------------------|---------------------|---------------|
| No  | Test item              |                     |               |
| T1  | Altitude Simulation    | Pass                |               |
| T2  | Thermal Test           | Pass                |               |
| T3  | Vibration              | Pass                |               |
| T4  | Shock                  | Pass                |               |
| T5  | External Short Circuit | Pass                |               |
| T6  | Impact                 | Pass                |               |
| T7  | Overcharge             | Pass                |               |
| T8  | Forced Discharge       | Pass                |               |

**15. Regulatory Information**

**U.S. Regulations**

**National Inventory TSCA**

All of the components are listed on the TSCA inventory.

**SARA**

To the best of our knowledge this product contains no toxic chemicals subject to the supplier notification requirements of Section 313 of the Superfund Amendments and Reauthorization Act (SARA/EPCRA) and the requirements of 40 CFR Part 372.

**Regulatory information EU**

**Labeling**

**Hazardous components which must be listed on the label**



As an article the product does not need to be labeled in accordance with EC directives or respective national laws.

**EU regulatory information**

1999/13/EC (VOC): 0 %

**16. Other Information**

**Hazardous Materials Information Label (HMIS)**

Health: 0  
Flammability: 0  
Physical Hazard: 0

**NFPA Hazard Ratings**

Health: 0  
Flammability: 0  
Reactivity: 0  
Unique Hazard:

**Full text of R-phrases referred to under sections 2 and 3**

- R10 Flammable.
- R20/22 Harmful by inhalation and if swallowed.
- R22 Harmful if swallowed.
- R34 Causes burns.
- R40 Limited evidence of a carcinogenic effect.
- R43 May cause sensitization by skin contact.
- R48/23 Toxic: danger of serious damage to health by prolonged exposure through inhalation.
- R49 May cause cancer by inhalation.
- R50 Very toxic to aquatic organisms.
- R53 May cause long-term adverse effects in the aquatic environment.

**Further Information**

Data of sections 4 to 8, as well as 10 to 12, do not necessarily refer to the use and the regular handling of the product (in this sense consult package leaflet and expert information), but to release of major amounts in case of accidents and irregularities. The information describes exclusively the safety requirements for the product

(s) and is based on the present level of our knowledge. This data does not constitute a guarantee for the characteristics of the product(s) as defined by the legal warranty regulations. "(n.a. = not applicable; n.d. = not determined)"

The data for the hazardous ingredients were taken respectively from the last version of the sub-contractor's safety data sheet.